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(54) APPARATUS FOR THE AUTOMATIC FEEDING OF ARTICLES TO PACKAGING MACHINES

(71) We, ALISYNCRO S.A.S. DI BRUNO & C., an Italian company, of Via Vinadio 16, Turin, Italy, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to apparatus for the automatic and continuous feeding of articles to packaging or wrapping machines, especially for packaging confectionery products.

Known wrapping or packaging machines for forming a protective covering, which may or may not be transparent around products to be wrapped have potentially a very high rate of operation, and to take advantage of this the machines must be fed without interruption in order to ensure that the articles to be packaged arrive at the machine uninterruptedly and at a rate proportional to the maximum packaging rate of the machine.

Since the feeding of articles to the machine cannot be effected manually, even by a large work force, it is necesary to feed the articles to the machine automatically, the article feeding conveyor forming part of the machine and being arranged to receive the articles as they are produced by another machine — for example an oven from which the products to be wrapped emerge on belts or other conveyor devices arranged in parallel paths. Where the articles to be packaged travel along conveyors in parallel rows, the rows must be brought together to form a single row before the articles reach the packaging machine. If the articles are elongated in shape the articles must be brought together in a single row with their major axes aligned.

An object of the present invention is to solve this problem by providing apparatus capable of feeding articles automatically and continuously to a packaging machine, the articles being fed in a single row, and the apparatus being supplied in use with articles travelling along several parallel paths.

Another object of the invention is to provide article feeding apparatus as aforesaid capable of enabling a packaging machine with which the apparatus is associated to operate at its maximum rate, so as to enable the full potential of the machine to be exploited without obstruction and moreover without damaging the articles to be packaged, even if they are very soft and sticky.

According to the present invention there is provided an apparatus for continuously and automatically feeding articles to a packaging or wrapping machine, the apparatus comprising a plurality of parallel belt conveyors of different lengths to which articles are supplied in rows, and a plurality of intermediate conveyors, equal in number to the number of belt conveyors and inclined substantially at right angles to the latter, said intermediate conveyors being adapted to transport articles from each respective belt conveyor to a single chain conveyor forming part of the machine, the intermediate conveyors being automatically controlled by means sensitive to the presence of the articles which allow operation of each said intermediate conveyors when articles are present at the entrance to the conveyor, the said intermediate conveyors being inoperative at other times, and the said control means being connected both to stop means for arresting the operation of each of the belt conveyors until the first article transported thereby is picked up by the corresponding intermediate conveyor, and to means for imparting to each belt conveyor a short movement backwards to disengage each article from successive

articles as soon as the article has been deposited upon the respective intermediate conveyor, and means for driving the mechanisms of the apparatus directly from the associated packaging machine.

The apparatus according to the invention in a preferred embodiment may be adapted to supply a conveyor for feeding the machine with articles superimposed on each other for the formation of piles.

The invention will now be further described, by way of non-limiting example, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of an article feeding apparatus according to one embodiment of the invention associated with a packaging machine for confectionery products;

Figure 2 is a perspective view of the apparatus on an enlarged scale;

Figure 3 is a plan view of the apparatus;

Figure 4 is a side elevation of the apparatus;

Figure 5 is a front elevation of the apparatus;

Figure 6 is a perspective view of the base of the conveyor belt assembly of the apparatus;

Figure 7 is a longitudinal section on an enlarged scale, taken along line VII-VII of Figure 3;

Figure 8 is a transverse section taken along line VIII-VIII of Figure 7;

Figure 9 is another transverse section taken along line IX-IX of Figure 3;

Figure 10 is a partial plan view, on an enlarged scale of the intermediate conveyors of the apparatus;

Figure 11 is a horizontal section taken along line XI-XI of Figure 9;

Figure 12 is a plan view of the mechanism for the control and transmission of drive to the apparatus;

Figure 13 is a partial diagrammatic plan view illustrating one of the intermediate conveyors forming part of an apparatus according to another embodiment of the invention;

Figure 14 is a diagrammatic transverse cross section, taken on line XIV-XIV of Figure 13;

Figure 15, is similar to Figure 13, illustrating the apparatus in another operative position;

Figure 16, is similar to Figure 14, and shows apparatus according to another embodiment of the invention;

Figure 17 is a partial diagrammatic plan view showing one of the intermediate conveyors forming part of an apparatus according to a further embodiment of the invention;

Figure 18 is a diagrammatic transverse section taken along line XVIII-XVIII of Figure 17;

Figure 19 is a perspective view of an apparatus according to a yet further embodiment of the invention;

Figure 20 is a front elevational view of the apparatus shown in Figure 19;

Figure 21 is a lateral elevation of the apparatus of Figure 19, partly in section, and

Figure 22 is a diagrammatic plan view of the apparatus of Figures 19 to 21.

Referring to Figure 1, reference numeral 1 indicates generally a packaging machine including a continuous chain conveyor 2 provided with article-engaging upstanding elements 2*a* (Figure 2). Articles A are conveyed to the conveyor 2 by means of article feeding apparatus 3 according to this invention.

The apparatus 3 comprises two vertical parallel side walls 4 supporting a first group 5 of endless conveyor belts of different lengths extending horizontally and parallel to the conveyor 2 of the machine 1. A group 28 of intermediate conveyors is arranged at right angles to the conveyor belts of the first group 5. In the embodiment of Figures 2 to 12 the intermediate conveyors are of the step by step type. The intermediate conveyors connect the output ends of the conveyor belts of the first group 5 with the chain conveyor 2, of the machine.

In the embodiment of Figures 2 to 12 the first group 5 comprises four belts 5*a*, 5*b*, 5*c* and 5*d* and the group 28 comprises four intermediate conveyors. Each of the belts 5*a*, 5*b*, 5*c*, 5*d*, as shown in Figures 6 and 7 runs upon a flat support plate 6 and passes around end rollers 7, 8, around an intermediate roller 9 carried by a short depending bracket 10 and around two tensioning rollers 11 carried by long depending brackets 12 arranged on both sides of a driving cylinder 13. The four driving cylinders 13 of the four belts 5*a*, 5*b*, 5*c* and 5*d* are mounted upon two parallel driving shafts 16.

As shown in Figure 8, each driving cylinder 13 is associated with an electromagnetic clutch 14 which upon actuation couples the cylinder 13 to the respective driving shaft 16 for the transmission of rotation to the cylinder. Each driving cylinder 13 is also associated with an electromagnetic brake 15 which upon actuation couples the cylinder 13 to fixed structure to stop the rotation of the cylnder 13. The two shafts 16 are driven by respective sprockets 18 mounted on one end of each shaft, externally of one of the side walls 4 (Figures 1 and 4) and interconnected by a sprocket chain 14. One of the shafts 16 carries a second sprocket 18′ which is driven by a sprocket chain 25 from a drive

sprocket, as described hereinafter. The two shafts 16 are rotatably supported in journal plates 17 mounted in the two side walls 4.

Each of the electromagnetic brakes 15 is carried by a lever plate 19 (Figure 6) having a downwardly projecting portion which is pivotally connected at a pivot 20 to a drawrod 21. Each drawrod 21 is attached to or integral with the core 22*a* of a respective electromagnet 22 carried by a supporting plate 23 (Figure 7). Under normal working conditions each driving cylinder 13 is coupled to the shaft 16 to advance the articles A carried on the respective conveyor belt, shown as the belt 5*d* in Figure 7. When the first of the articles A conveyed, as shown in broken outline in Figure 7, arrives at the associated intermediate conveyor, it intercepts a vertical light beam directed by a projector 75 upon a photocell 76, causing the photocell 76 to provide a signal whch is utilized to release the electromagnetic clutch 14 and to operate the electromagnetic brake 15, so that the belt 5*d* stops; in the meantime the electromagnet 22 is energised, moving the drawrod 21 to the left as viewed in Figure 7, and causing the lever plate 19 and the brake integral with the plate 19 to impart to the cylinder 13 a slight rotation such as to move the belt 5*d* backwards sufficiently to separate the articles carried by the conveyor belt step by step from the article deposited on the intermediate conveyor. The photocells and the respective projectors associated with each conveyor belt are carried by brackets 74 supported by a flat plate 29 along which the articles carried by the intermediate conveyors are advanced intermittently.

As shown in Figures 9 and 10, each intermediate conveyor is constituted by a pair of parallel conveyor rods 30 provided with upwardly projecting teeth 30′ at regular intervals and adapted to run along parallel channels extending along each side of the respective plate 29 along which the articles are advanced. In Figure 10 the pairs of rods of the four conveyors are indicated by 30*a*, 30*b*, 30*c* and 30*d* and their respective projecting lugs by 30′*a*, 30′*b*, 30′*c* and 30′*d*.

In practice the article support plates 29 are coplanar and are supported by a framework 31 (Figure 9) carried by vertical columns 32 resting on a lower bearing structure 33 on which an intermediate horizontal plate 34 is also carried.

The framework 31 carries two parallel horizontal sleeves 35 in which respective parallel rods 36 are mounted for relative longitudinal movement by means of respective circulating ball bearings. The opposite ends of the rods 36 are fixed to two cross beams 37, one of which is connected centrally through a horizontal pivot 39 to a drawrod 38 the opposite end of which is in turn connected to a pivot pin 40 pivotally engaged in a slot 41 in a longer arm 42*a* of a right-angled bellcrank lever 42. The bellcrank lever 42 is pivoted about a large horizontal shaft 55 the opposite ends of which are supported by two vertical parallel plates 26*a* situated between the framework 31 and the bearing structure 33 (see Figure 11). The shorter arm 42*b* of the bellcrank lever 42, shown in broken outline in Figure 9, carries a freely rotatable roller 43 engaged in a channel of a desmodromic cam 44 carried by a horizontal shaft 59 extending parallel to the shaft 55. The rotation imparted to the shaft 59 and thus to the desmodromic cam 44 cause rocking movements of the lever 42, so that the framework formed by the two beams 37 and by the rods 36 reciprocates horizontally.

The two beams 37 of the reciprocating framework have respective upper horizontal pivot pins 45 on which respective triangular levers 46, 46*a* are pivotally supported, the said levers being pivotally connected by horizontal pins 47 to two respective depending lugs 48 provided at opposite ends of the two respective conveyor rods 30. The two triangular levers 46, 46*a* of each conveyor are connected together by an upper drawrod 50 pivotally connected through pivot pins 49 to the upper parts of the two levers. Eeach of the levers 46*a* is connected through a further horizontal pivot pin 51 to a resiliently extensible drawrod 52, the lower end of which is articulated at 53 to the longer arm 54*a* of a respective right angled bellcrank lever 54 rotatably mounted on the same shaft 55 as the other bellcrank lever 42. The shorter arm 54*b* of the bellcrank lever 54 carries a roller 57, shown in broken outline in Figure 9, which cooperates with the external profile of a respective cam 58 carried by the shaft 59 which carries the desmodromic cam 44 (Figure 11). A respective spring 56 fixed to the lower bearing structure 33 holds the roller 57 against the respective cam 58.

Each pair of conveyor rods 30 is thus connected through the respective bellcrank lever 54 to the respective cam 58 which is rotated continuously by the shaft 59.

The shorter arm 54*b* of each bellcrank lever 54 carries a pawl 60 able to engage in a hooked end 61*a* of a lever 61 pivoted at its other end to a fixed pivot 62 (Figure 9). Intermediate its ends the lever 61 is connected, through a pivot 63, to the movable armature of an electromagnet 64 positioned vertically. Under rest conditions the hooked lever 61 is held in the lowered position by a spring 65 and engages the

pawl 60 of the bellcrank lever 54 and prevents rocking movement of the latter, despite rotation of the cam 58.

When an article A interrupts the light beam impinging on the corresponding photocell 76, the electromagnet 64 is activated and the hooked end 61*a* of the lever 61 is lifted, freeing the bellcrank lever 54. The lever 54 can therefore rock under control of the cam 58 to move the conveyor rods 30 upwards at the same time as a forward movement by one step of the entire mobile framework. Therefore the projecting teeth 30′ of the conveyor rods 30 project beyond the plate 29, causing movement of the articles which are pushed along the plate by the teeth. If there is no article at the end of the corresponding conveyor belt feeding the intermediate conveyor the electromagnet 64 is not energised and the bellcrank lever 54 remains inoperative. Therefore the respective conveyor rods 30 do not rise, whilst those of the conveyors to which articles have been conveyed operate as described.

A sprocket 66 is keyed to one end of the cam shaft 59 (Figures 11, 12) and is connected through a sprocket chain 67, to a sprocket 68 carried by a gear transmission unit 69 of known type connected to a shaft 70 which is in turn driven by a similar gear unit 71 connected to an inclined transmission shaft 72 through cardan joints, the shaft 72 being connected to the packaging machine 1. The gear transmission unit 71 has a third output shaft which carries a sprocket 73 connected through a chain 25 to the sprockets 18, 18′ which drive the shafts 16 of the cylinders 13 for driving the belt conveyors 5.

The apparatus can operate in two distinct phases. The articles A are conveyed by the belt conveyors 5 and the intermediate conveyors 28 to the chain conveyor 2 which feeds the articles to the packaging machine in a single row while maintaining the orientation of the articles unchanged. The apparatus may be coupled to one or more similar arrangements when the machine has to be supplied with articles simultaneously from several ovens.

The mechanism of the apparatus is enclosed in a cabinet 26 supported by adjustable feet 27.

Given the high rate of working of the packaging machine, the intermediate transporters 28 must move the articles A at high speed; if the articles are tender and soft, the use of intermittent or stepwse conveyors could damage the articles since the conveyor teeth impart to the articles a series of repeated impulses. Thus after each stepwise advance the articles are brought to rest abruptly and then suddenly advanced in the successive step, being subjected each time to considerable decelerations and accelerations.

Moreover, if the articles are sticky, as is often the case with confectionery products, they may stick to the conveyor support plates 29, with even more serious consequences.

To avoid these disadvantages it is possible to use an apparatus in which each intermediate conveyor for moving the articles A supplied thereto by the belt conveyors 5 to the chain conveyor 2 of the machine is constituted by an endless or continuous conveyor. Apparatus of this type is shown in Figures 13 to 18 in which, to simplify the drawings. only one of the conveyors 5 is shown, connected by an intermediate conveyor to the chain conveyor 2 which feeds the machine.

In the example shown in Figures 13 to 15 the intermediate conveyor is formed by an endless roller chain 82 disposed in a vertical plane and provided with upstanding radial traction elements 83 intended to draw the articles along a horizontal support plate 29 which defines the working plane of the conveyor. The plate 29 is provided with a transverse slot 81 through which project respective traction elements 83 carried by the upper section of the chain; the slot 81 is situated between two parallel guides 80 intended to prevent any deviations of the articles conveyed. The chain 82 passes at its rear end around a driving sprocket 84, whilst the front end passes around a freely rotatable idler sprocket 85 carried by one arm of a right-angled bellcrank lever 86 mounted for rotation about a horizontal axis 87. The arrangement of the parts is such that the initial section 82*a* of the chain 82, comprised between the sprocket 85 and a fixed gear 88, may remain inactive and be arranged below the working plane whenever there are no articles present to convey. The bellcrank lever 86 is acted upon by a spring 89 which urges the lever 86 to rotate in a clockwise direction as shown in the drawing to bring the initial section 82*a* of the chain 82 into the working position coplanar with the working plane. The second arm of the bellcrank lever 86 is releasably connected to one arm of a second right-angled bellcrank lever 93 through a pivot 90, a connecting rod 91 and a pivot 92. The bellcrank lever 93 is mounted on a fixed pivot 94 and its other arm carries a freely rotatable roller 95 which cooperates with a rotatable cam 96.

The connecting rod 91 carries a tooth 97 which cooperates with a toothed stop device 98 actuated by an electromagnet 99.

When the initial section 82*a* of the chain 82 is to remain inactive, that is, in the lowered position, as shown in Figure 14, the electromagnet 99 is de-energised and

the stop device 98 engages the tooth 97 of the connecting rod 91, preventing the connecting rod itself from moving to the left (as viewed in the drawing) under the action of the spring 89 when the portion of the cam 96 of smallest radius cooperates with the roller 95 of the second oscillating lever 93. When the control device 74' gives consent to activate the initial section 82*a* of the chain, the electromagnet 99 becomes energised and the stop device 98 is raised, as shown in Figure 15, disengaging from the tooth 97 of the connecting rod 91. At this point the mechanism can move to cause cause lifting of the initial section 82*a* of the chain, when the smallest radius portion of the cam 96 cooperates with the roller 95.

To transfer the articles A to the chain conveyor 2 of the machine at the speed demanded by working rate of the machine, the apparatus may be provided in the terminal section of the intermediate conveyor with an acceleration group formed by two rods 102 extending parallel to the chain 82 and situated on the opposite side with respect to the latter, the rods 102 being provided at their free ends with tips 101 able to project on to the work surface 29 through two parallel longitudinal channels 100 made in the terminal section of the path of the conveyor. Each rod 102 rests with its rear end on a cam 103 mounted on the same shaft as that on which the chain driving sprocket 84 is mounted. Each rod 102 carries at its rear end a longitudinal channel 104 engaged by a pin 105 carried by the free end of an oscillating lever 106 pivoted at its opposite end to a fixed pivot 107. The lever 106 carries intermediate at its ends a freely rotatable roller 108 which cooperates with a cam 109. A spring 110 urges the lever 106 into engagement with the cam 109.

As shown in Figure 14, in the retracted position of the traction elements 83, the cam 103 presents the lowest part of its profile to the respective rod 102 so that the tip 101 of the rod remains below the conveyor support plate 29; at the same time the cam 109 presents its maximum radius portion to the roller 108 of the lever 106, so that the rod 102 is moved towards the left as viewed in Figure 14 to the fullest extent of its stroke.

Gradually, as the cam 109 rotates, the lever 106 rotates, as viewed in Figure 14, in anticlockwise direction and thrusts the rod 102 towards the chain conveyor 2 of the machine, whilst the cam 103 presents its portion of maximum radius to the rod 102, causing projection of the tip 101 above the plate 29, as shown in Figure 15.

The two traction elements 83 pick up the articles A which have been abandoned by the chain 82 and thrust them with considerable acceleration towards the chain conveyor 2 of the machine.

When the consistency of the articles A does not allow use of the abovementioned traction elements 83, recourse may be had to the variant of the apparatus shown in Figure 16, in which the final section of the movement of the intermediate conveyor is effected with the aid of a small belt conveyor 111, interposed between the end of the chain 82 and the chain conveyor 2 of the machine.

According to another embodiment, shown in Figures 17 and 18, the apparatus may include a continuous chain 112 disposed in a horizontal plane, situated parallel to and below the support plate 29. The chain 112 is provided with oscillating cams or latches 113, of substantially square conformation, which, in the active section of the conveyor, are caused to move so as to project from the support plate 29 and move along the slot 81 in the latter, to thrust the articles A along the conveyor; in the inactive section of the conveyor the latches 113 are on the other hand turned down so as to remain below the support plate 29.

The chain 112 passes at one end around a sprocket 114 of large diameter driven by a pair of bevel gears 115, 116; at its other end the chain 112 passes around an idler sprocket 118. If necessary, other return sprockets 117 may be used. In the active section of the conveyor the oscillating latches 113 of the chain cooperate with a fixed guide 119 situated below the chain 112 and extending over the whole of the effective length of the latter, including a terminal section in correspondence with which the running track and the lateral guides 80*a* curve in order to guide the articles obliquely on to the chain conveyor 2 of the machine. Also in this case in the initial section of the chain 112 the oscillating latches 113 may be rendered inactive if there are no articles to be picked up. For this purpose, in front of the fixed guide 119 there is situated a movable guide 120 constituted by one arm of a right-angled bellcrank lever 86 similar to that of the apparatus illustrated in Figures 13 to 15, and connected to a connecting rod 91 and to a second oscillating lever 93. The lever 93 is controlled by a cam 96 and subject to the action of a control electromagnet 99. In the rest condition, as shown by the full line in Figure 18, the lever 86 is lowered and the latches which pass over this section of the conveyor are not raised. If on the other hand the electromagnet 89 is energised it permits rotation of the cam 96 which causes rotation of the lever 86 in the clockwise direction, the movable guide 120 being placed coplanarly to the fixed

guide 119 causing raising of the latches 113 which pass over it.

With this arrangement the articles are accompanied over the entire extent of their high speed movement, comprised between the supply conveyor belt and the chain conveyor 2 without being subjected to any damage.

Figures 19 to 22 show a variant of the apparatus which permits the formation of piles of articles to be fed to the packaging machine; the apparatus, in the illustrated examples, has a plurality of supply conveyor belts 5' of different length, and a plurality of intermediate conveyors 28' for example of the intermittent or step-by-step type which convey the articles supplied by each conveyor belt 5' to the single conveyor 2 of the machine.

In the example illustrated, there are four conveyor belts 5'. The first two conveyor belts 5'*a*, 5'*b* are coplanar with each other, and cooperate with two intermittent conveyors 30*a*, 30*b* adapted to shift the articles along a support plate 29 which is coplanar with the conveyor belts and arranged in the same plane as a first guide 121 parallel to the feed conveyor 2 of the machine. The other two belts 5'*c*, 5'*d* each have on the other hand an ascent section so that their end sections, which are coplanar with each other, may be disposed in a higher plane than that in which the first two belts 5'*a*, 5'*b* are disposed. The two belts 5'*c* and 5'*d* cooperate with two intermittent conveyors 30'*c*, 30'*d* which move the articles along a second support plate 29', coplanar with the terminal sections of the belts themselves and situated in the same plane as a fixed guide 121' extending along one section of the feeding conveyor 2 of the machine, situated to the rear of the section along which the first guide 121 extends. With this arrangement articles B carried by the first two conveyor belts 5'*a*, 5'*b* and by the first two intermittent conveyors are inserted directly on the chain conveyor 2 of the machine, whilst articles C carried by the second conveyor belts 5'*c*, 5'*d* and by the second two intermittent conveyors, become superimposed upon the articles B already deposited on the chain conveyor 2, forming a pile of superimposed articles. If the pile is to be formed of more than two layers of articles there will be further conveyor belts and further transverse conveyors situated in planes arranged at even greater heights. It is evident that in this case the upstanding thrust elements 2*b* of the chain conveyor 2 of the machine will have greater height to advance the piles of articles thus formed.

The intermediate conveyors can in this case also be constituted of chain conveyors of the type illustrated previously.

The control means for the belt conveyors and the intermediate conveyors could be constituted by any suitable control devices other than the illustrated photocells, for example, fluid-operated, mechanical or other detectors.

WHAT WE CLAIM IS:—

1. Apparatus for continuously and automatically feeding articles to a packaging or wrapping machine, the apparatus comprising a plurality of parallel belt conveyors of different lengths to which articles are supplied in rows, and a plurality of intermediate conveyors, equal in number to the number of belt conveyors and inclined substantially at right angles to the latter, said intermediate conveyors being adapted to transport articles from each respective belt conveyor to a single chain conveyor forming part of the machine, the intermediate conveyors being automatically controlled by means sensitive to the presence of the articles which allow operation of each said intermediate conveyors when articles are present at the entrance to the conveyor, the said intermediate conveyors being inoperative at other times, and the said control means being connected both to stop means for arresting the operation of each of the belt conveyors until the first article transported thereby is picked up by the corresponding intermediate conveyor, and to means for imparting to each belt conveyor a short movement backwards to disengage each article from successive articles as soon as the article has been deposited upon the respective intermediate conveyor, and means for driving the mechanisms of the apparatus directly from the associated packaging machine.

2. Apparatus according to Claim 1, in which the intermediate conveyors are of the step-by-step or intermittent type and are constituted by pairs of parallel horizontal rods provided with upwardly projecting elements and forming part of a single framework which is reciprocated horizontally under the control of a desmodromic cam, the respective pairs of rods being mounted for substantially vertical movement relative to the framework under the control of respective cams which rotate in synchronism with the desmodromic cam, so that during the article advancing movement of the framework the rods are displaced upwards so that their upwardly projecting elements project above a horizontal support plane on which the articles rest, thereby advancing the articles by one step, whilst during the return movement of the framework the rods are displaced downwards to retract their projecting elements below the support plane.

3. Apparatus according to Claim 2, in which the respective pairs of rods of the intermediate conveyors are connected to the

respective cams by connecting means which are controlled by locking devices operable by electromagnets which form part of the control means sensitive to the presence of the articles, said locking devices being operative to keep the connecting means in a non-operative position to prevent raising of the rods when there are no articles to be moved on the respective intermediate conveyor.

4. Apparatus according to Claim 1, Claim 2 or Claim 3, in which each of the belt conveyors is driven by a driving cylinder mounted coaxially to a driving shaft and associated with an electromagnetic clutch operative to couple the cylinder to the shaft and with an electromagnetic brake operative to arrest rotation of the cylinder.

5. Apparatus according to Claim 4, in which the means for imparting to each belt conveyor a short backwards movement comprise an electromagnet which upon energisation operates the electromagnetic brake of each driving cylinder when the respective electromagnetic clutch is disengaged, the said electromagnet being energised by the said control means, which are sensitive to the presence of articles on the path of the respective intermediate conveyor.

6. Apparatus according to Claim 1, in which each of the intermediate conveyors is constituted by an endless or continuous conveyor provided with article-engaging projections which are adapted to draw the articles along a support plate, the belt having an initial section which can be rendered inoperative whenever there is no article to be conveyed upon it.

7. Apparatus according to Claim 6, in which each intermediate conveyor is constituted by a roller chain.

8. Apparatus according to Claim 7, in which the continuous chain constituting the intermediate conveyor is disposed in a vertical plane and is furnished with radial projections which move in a channel made in a support plate on which the articles move, the initial section of the chain being movable by a toothed driving sprocket carried by an oscillating lever which is controlled by a cam able to promote raising of the pinion to render the initial section of the chain operative, the movement of the said sprocket being controlled by an electromagnet connected to control means sensitive to the presence of the articles.

9. Apparatus according to Claim 8, in which the terminal section of the chain cooperates with a thrust group constituted by two parallel rods, situated on the two sides of the chain, and provided at their upper ends with tips adapted to project through two parallel channels in the article support plate, the upper ends of the rods being supported by profiled cams carried by the same shaft as the toothed driving sprocket of the chain and being controlled by oscillating levers cooperating with rotating cams.

10. Apparatus according to Claim 8, in which the terminal section of the chain cooperates with a small belt conveyor adapted to move the articles at high speed towards the feed conveyor of the machine.

11. Apparatus according to Claims 6 and 7, in which the chain constituting one of the intermediate conveyors lies in a horizontal plane and is provided with rotatable latches which are controlled to be brought into an operative position in the active section of the chain or in a retracted position in the inactive sections; the path of the said chain having a curved terminal section along which the articles travel obliquely on to the feeding conveyor of the machine.

12. Apparatus according to Claim 11, in which a movable guide is situated in the initial section of the chain and is adapted to cause movement of the latches which pass in that section into their operative positions according to their own position, such guide being carried by a pivoted lever connected to a cam and the movement of the guide being controlled by a stop device operable by an electromagnet controlled by the control means sensitive to the presence of the articles.

13. Apparatus according to any one of the preceding claims, in which the discharge ends of the belt conveyors are arranged on at least two separate planes and the intermediate conveyors operate on at least two separate parallel planes, coplanar with the discharge ends of the belt conveyors, to carry the articles to the feed conveyor of the machine in two superimposed layers, thus enabling the formation of piles of articles each of which is constituted by at least two superimposed articles.

14. Apparatus for automatically feeding articles to a packaging machine, substantially as herein described with reference to and as shown in Figures 1 to 12, or Figures 13 to 15, or Figure 16, or Figures 17 and 18, or Figures 19 to 22 of the accompanying drawings.

For the Applicants:
F. J. CLEVELAND & COMPANY,
Chartered Patent Agents,
Lincoln's Inn Chambers,
40-43 Chancery Lane,
London WC2.

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1413385 COMPLETE SPECIFICATION
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Sheet 1

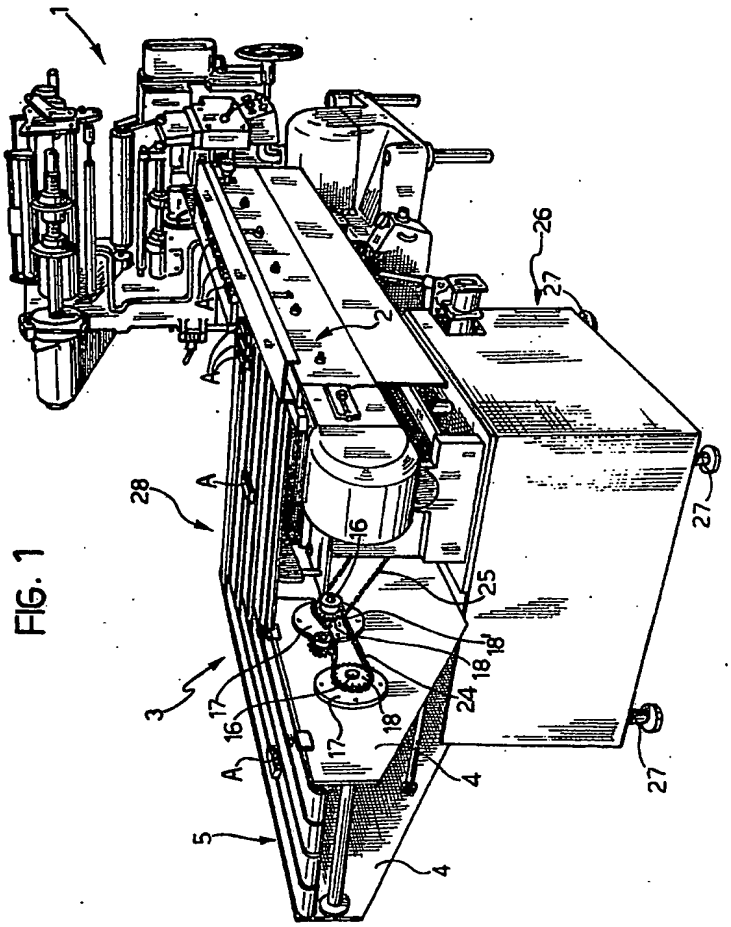
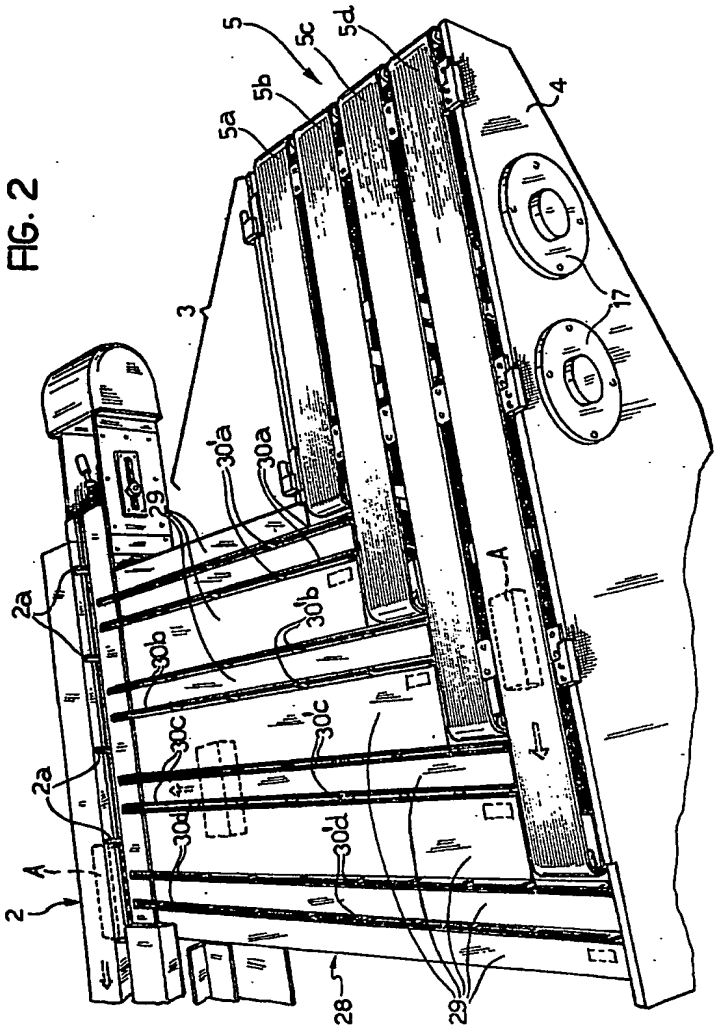


FIG. 1

FIG. 2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5b
5a
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2a
30d
30'd
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FIG. 3

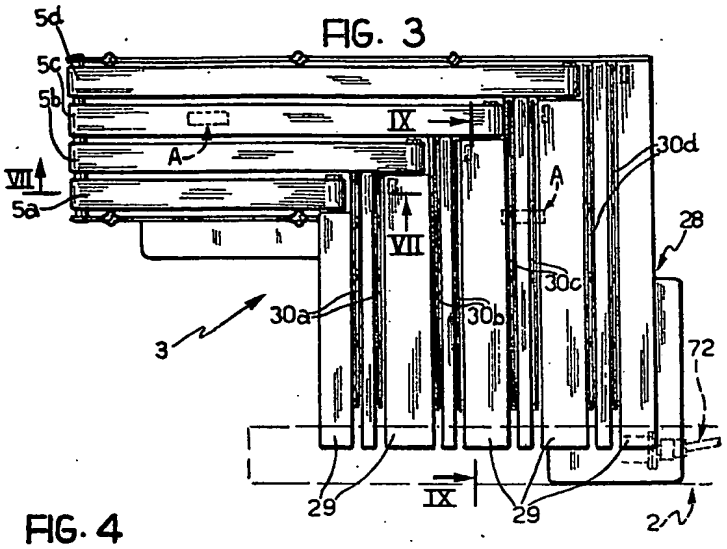
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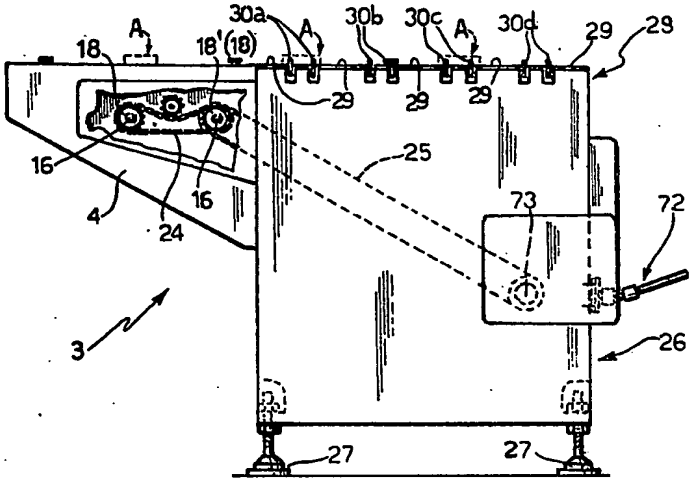
FIG. 4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3
27

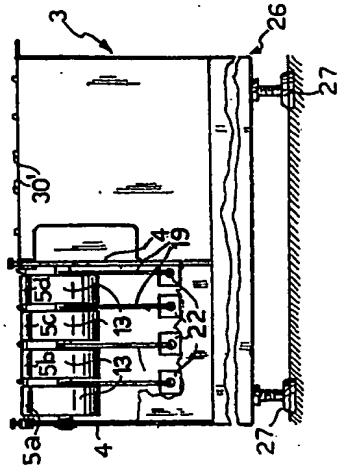


FIG. 5

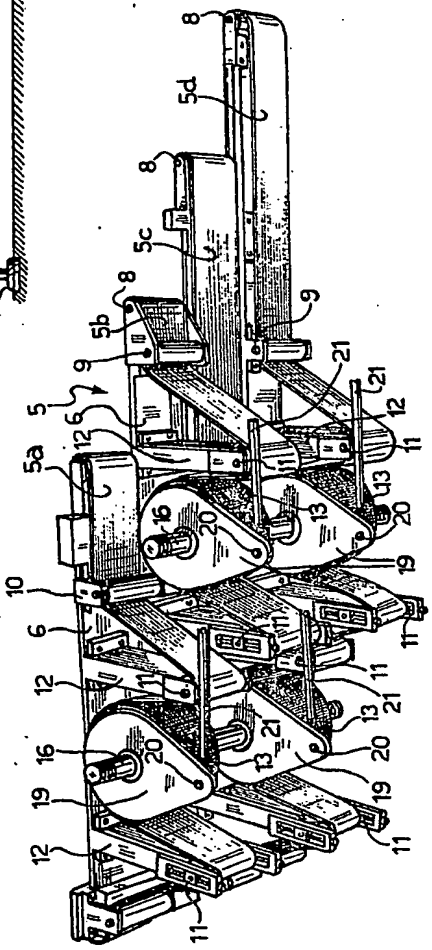


FIG. 6

1413385 COMPLETE SPECIFICATION
10 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 5

FIG. 7

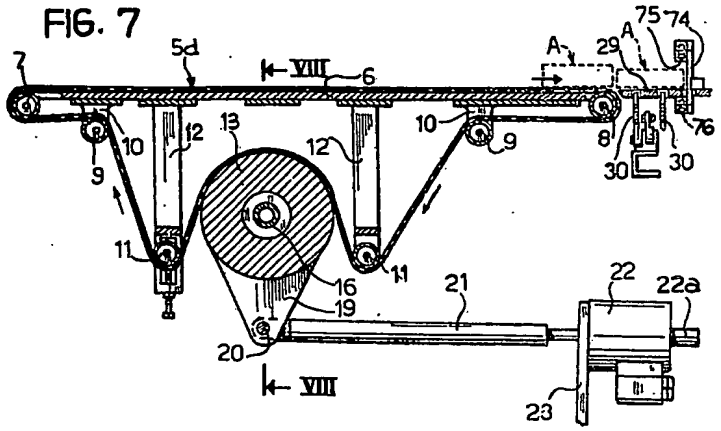


FIG. 11

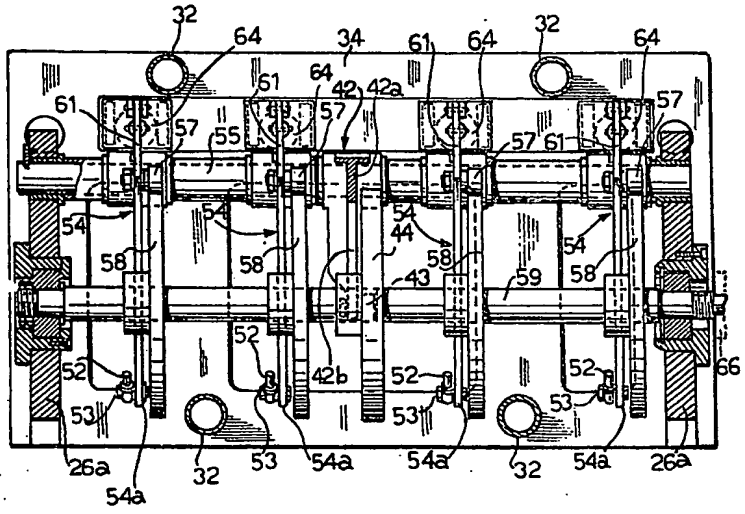


FIG. 8

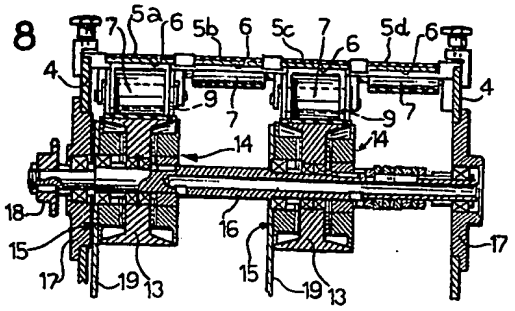

5a
5b
5c
5d
6
7
4
9
14
18
15
16
17
19
13

FIG. 9

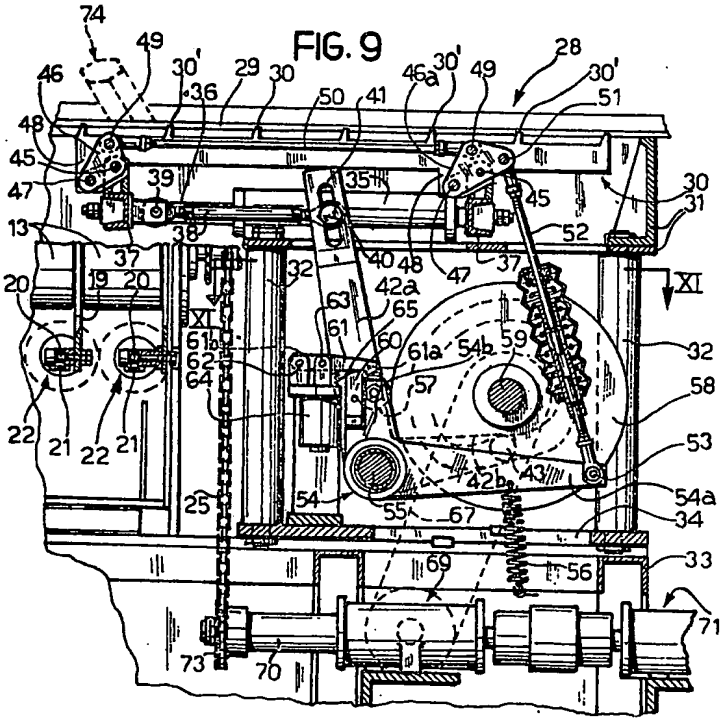

74
49
30'
46
29
30
36
50
41
46a
28
51
48
45
39
35
47
38
52
31
13
37
40
48
42a
63
65
61
60
61a
54b
59
32
20
19
XI
61b
62
64
57
58
22
21
53
42b
43
54a
25
54
55
67
34
69
56
33
71
73
70

FIG. 10

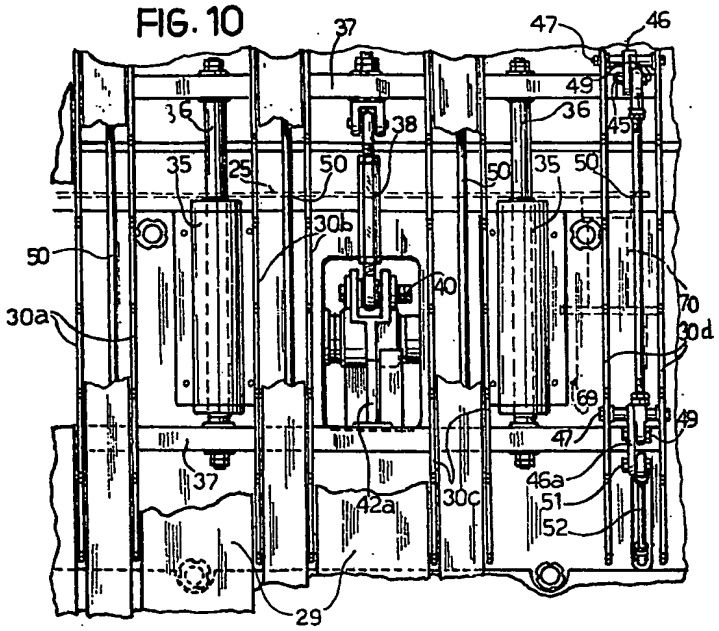

37
47
46
49
36
38
45
35
25
50
50
35
50
30b
50
40
30a
70
30d
68
49
47
37
46a
51
42a
30c
52
29

FIG. 12

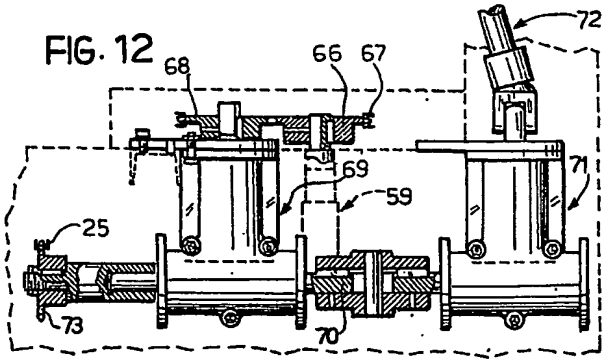

72
68
66
67
69
71
59
25
73
70

FIG.13

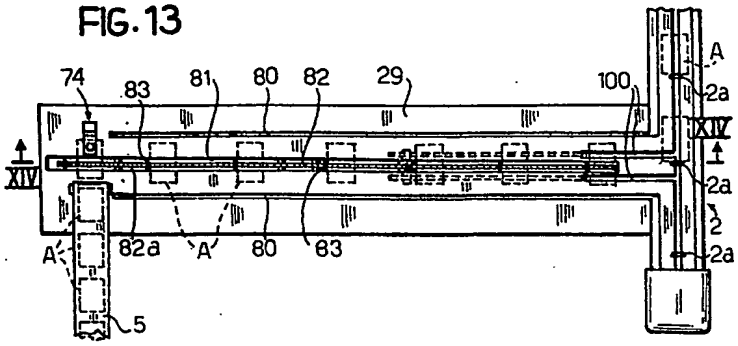


FIG.14

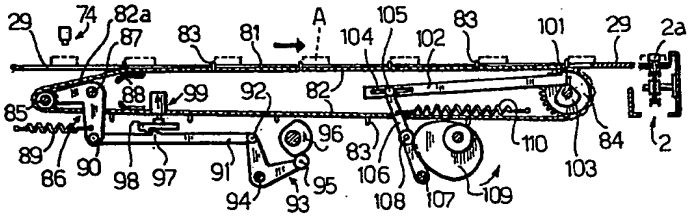


FIG.15

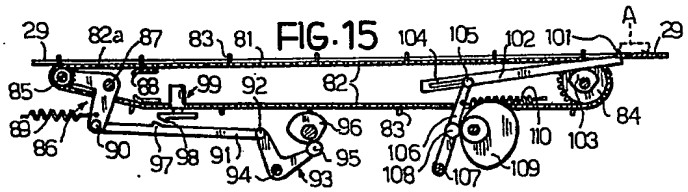


FIG.16

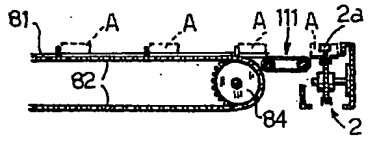


FIG. 17

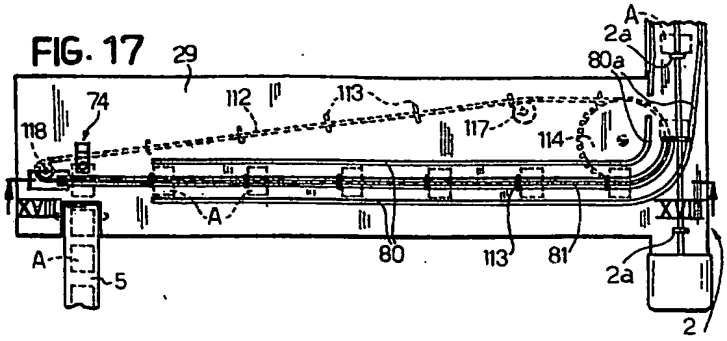


FIG. 18

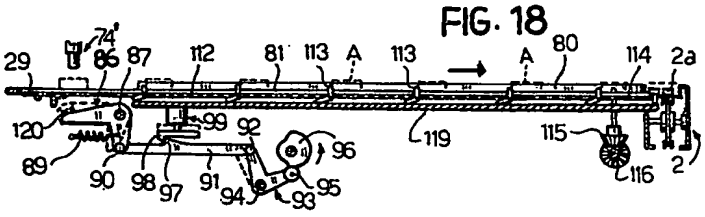


FIG. 21

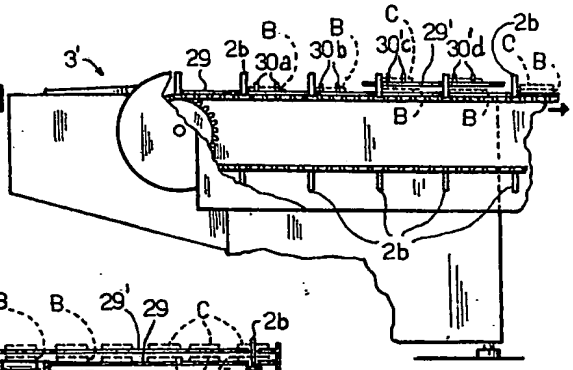


FIG. 20

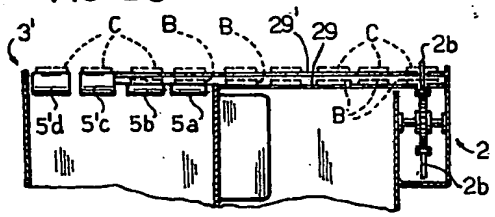


FIG. 19

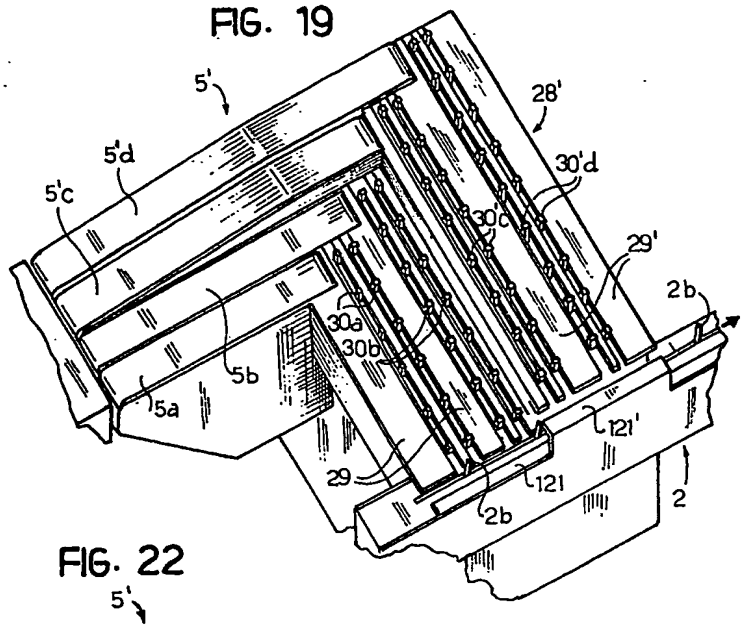
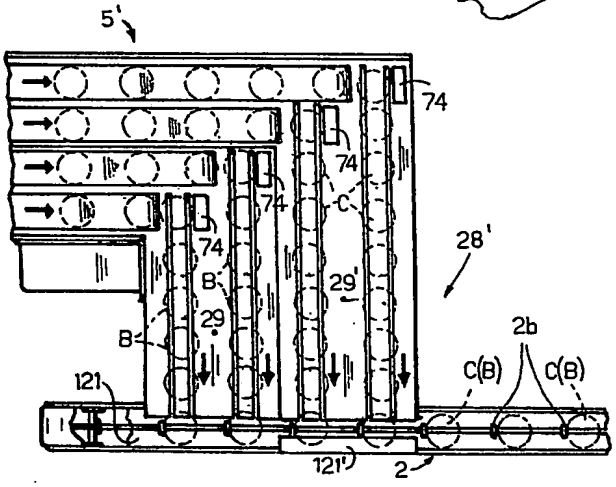

5'
28'
5'd
30'd
5'c
30'c
29'
2b
30a
30b
5b
5a
121'
29
121
2b
2

FIG. 22


5'
74
74
74
74
C
28'
B
29'
B
29
2b
C(B)
C(B)
121
121'
2